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For farrowing houses . . .

air conditioning



Cooperative Extension Service
South Dakota State University, Brookings
U. S. Department of Agriculture

Air Conditioning for Farrowing Houses

By Mylo A. Hellickson and Harvey G. Young, associate professors, Agricultural Engineering Department, Agricultural Experiment Station; and G. R. Durland, agricultural engineer, Cooperative Extension Service.

Multiple farrowing schedules and systems adopted by many swine producers to "stretch" the season have increased the need for improved environmental control in the farrowing house. Maintaining temperatures near the best performance range of both sows and baby pigs has proven highly profitable. Desirable temperatures for sows and baby pigs differ greatly with the sow performing best at approximately 60 degrees (F.) while newborn pigs are most comfortable and healthy at 85-90 degrees (F.). Sow and pigs will produce best if these environmental temperatures are maintained for both summer and winter operation. Suggestions and floor plans for winter heating and summer cooling are included in this publication.

During cold weather the farrowing house temperature is commonly maintained at the comfort level of the sow and the creep area is kept at 80-90 degrees using supplemental heating systems. Summer farrowing has traditionally been a period of moderate to severe heat stress for the sow, since usually little or no effort has been made to mechanically reduce temperatures to her comfort level. Being confined to a pen or crate she has no opportunity to seek a cooling breeze or moist area for relief. Consequently, swine producers have encountered poor litter performance and increased mortality during periods of extreme heat stress. Producers using free stall systems may have the added problem of sows vacating their stalls for extended periods of time to seek temperature relief. Light weaning weight and early weaned pigs often are the result.

Studies by the Agricultural Experiment Station at SDSU have shown that a comfortable hot weather environment can be created for the sow

by directing a stream of cooled air over her snout and head (Figure 1) without materially affecting temperatures in the creep area, if standard methods of maintaining desired temperatures in the pig creep areas are employed. The use of cooled air directed toward the heads of sows in free stalls has been profitable in terms of improved litter gains, sow comfort and increased stall occupancy. Similar results can be anticipated in systems using conventional farrowing crates or stalls.

Equipment

A heat pump or conventional air conditioner, either the window-type or central system, can be used for providing cooled air. It is very important that *only fresh air be drawn past the cooling coil and directed toward the sows*. If air from the farrowing building is recirculated, ammonia present in the swine building will combine with water condensed on the cooling coil and cause excessive corrosion.

System Design

Adequate ventilation is as important for summer cooling as it is for winter operation. Air flow rates sufficient to remove moisture and odors must be provided. The exhaust system planned for normal winter operation will perform adequately with the cooling system. Plan to operate the exhaust fans at a rate of at least 50 cubic feet per minute (cfm) per sow and litter and set the thermostat to operate at 65 degrees.

Cooling rates recommended for use in a farrowing house are 1,500 Btu/hr or $\frac{1}{8}$ -ton refrigeration capacity per sow. The air conditioning fan (fresh air) is designed to operate continuously, but may be manually stopped in cool weather if a supplemental exhaust fan is

used. The compressor is thermostatically controlled to provide cooling when farrowing house temperature exceeds 65 degrees. The air conditioning blower should have a delivery rate of at least 50 cfm per sow rated at $\frac{1}{8}$ -inch static pressure.

Distribution Ducts

Air distribution ducts (Figure 6) should be about one-foot square in cross section and constructed of $\frac{3}{4}$ -inch plywood or other suitable material. The duct may be suspended from the ceiling or placed on top of the farrowing stalls or crates. A flexible air tube (Figure 3) is located over each sow and should extend about 2½ feet above the floor surface. An air flow adjustment is required to balance the flow rates throughout the structure and to prevent air delivery into empty stalls.

Farrowing house plans showing suggested air conditioner or heat pump installation and air delivery duct locations are shown in Figures 1, 2 and 3. A typical cross-section of a farrowing house showing air delivery ducts and flexible tubes is shown in Figure 7.

Figures 4 and 5 illustrate typical installations of air conditioning units in farrowing houses. Figure 4 is a package unit installation typical of a window-type air conditioner or heat pump. The duct work for the fresh air inlet may be constructed as shown. The cross-section dimensions of the duct should be equal to those of the air distribution duct. At least one filter is required and should be located where replacement or cleaning is convenient. The ventilation baffle is installed for *heat pump use only* and is used for cold weather operation. If the ventilation baffle is installed, the filter

ing system should be situated in the duct between the baffle and heat pump.

The split unit or central air conditioning system installation is shown in Figure 5 and is a much simpler installation, since the construction of the inlet duct is simplified and the cooling coil may be placed in the duct. A filtering system is also required with this unit. Thermostats for the cooling system are located in the farrowing unit at a position for convenient observation and adjustment.

Winter Operation

The heat pump system can also be employed for heating the farrowing barn during winter operation. This will require the addition of supplemental heaters and ventilation baffle (Figure 4) to allow warm farrowing barn air to be recirculated through the system. The ammonia in the air will not react with the air conditioning coil when it is being used to heat the air. During winter operation the flexible air tubes should be positioned to direct the air horizontally into the barn. The thermostat used for summer operation is also used to control

the heat pump and supplemental heaters for winter operation. Research has indicated that the heat pump system does an excellent job of maintaining

comfortable environmental temperatures during cold weather but the operating cost is higher than that of the more conventional heating systems.

Table 1. Ratings and costs* of air conditioners for various numbers of sows

Size Tons	Blower Rating cfm/sow	CFM	Cost	No. of Sows
2	64	1100	\$483	16
2½	65.5	1310	588	20
3	54.6	1310 or more	731	24
4	46.8	1310 or more	895	28

*Cost estimates based on estimates provided by a/c dealers, August, 1972.

Table 2. Summary of farrowing house ventilation, heating and cooling requirements.

Number of sows and litters	Normal winter ventilation cfm	Louver and inlet area sq. in.*	Supplemental Heat		Air Conditioning	
			Slotted floor Btu per hour	Solid floor Btu per hour	Cooling capacity tons†	Fan size cfm
10	800	200	15,000	20,000	1.25	500
12	960	240	18,000	24,000	1.50	600
14	1120	280	21,000	28,000	1.75	700
16	1280	320	24,000	32,000	2.00	800
20	1600	400	30,000	40,000	2.50	1000
24	1920	480	36,000	48,000	3.00	1200
28	2240	560	42,000	56,000	3.50	1400
32	2560	640	48,000	64,000	4.00	1600
40	3200	800	60,000	80,000	5.00	2000

*See Midwest Plan Service Equipment Book (MWPS 8) for ventilation inlet details.

†One ton of air conditioning capacity equals 12,000 Btu's per hour.

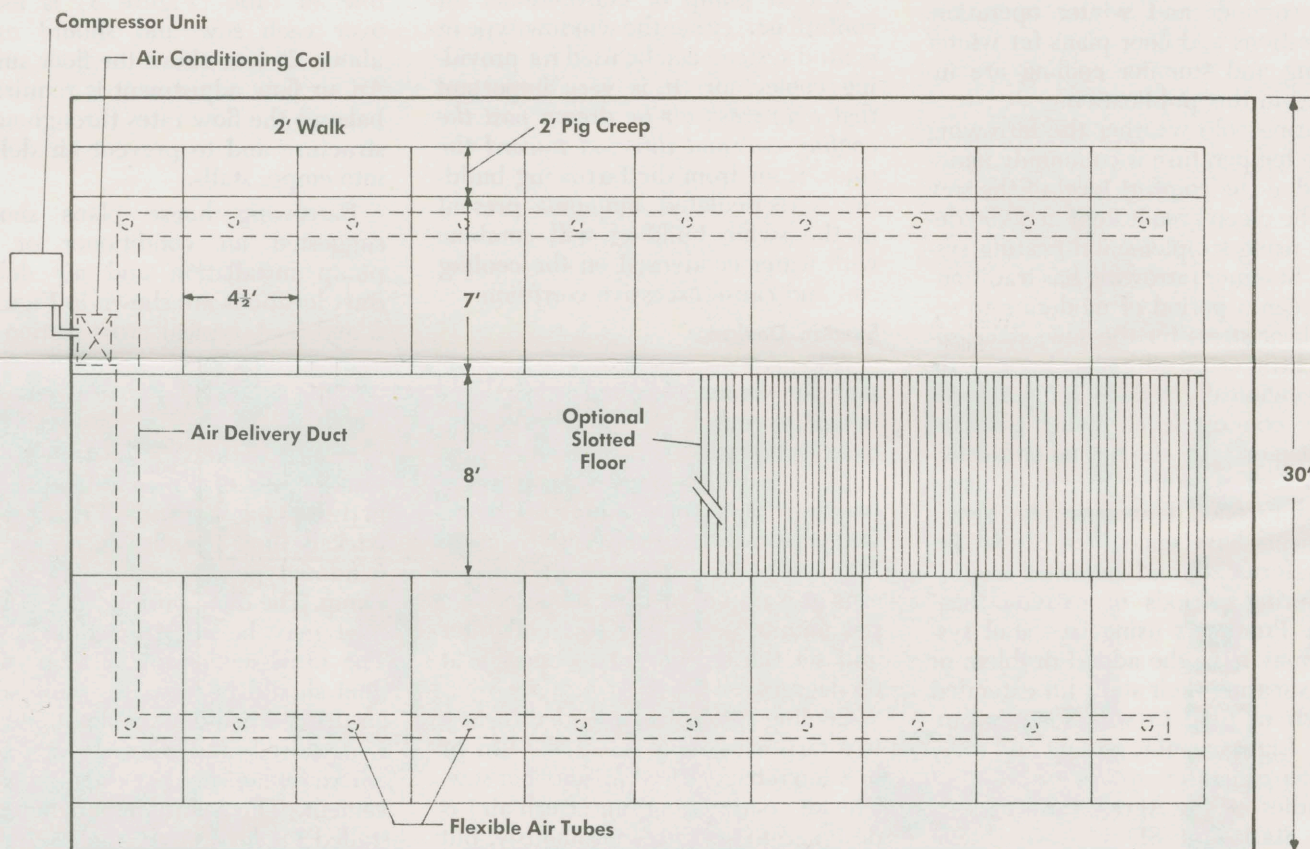


Figure 1—Free Stall Farrowing Barn—Partial Environmental Control

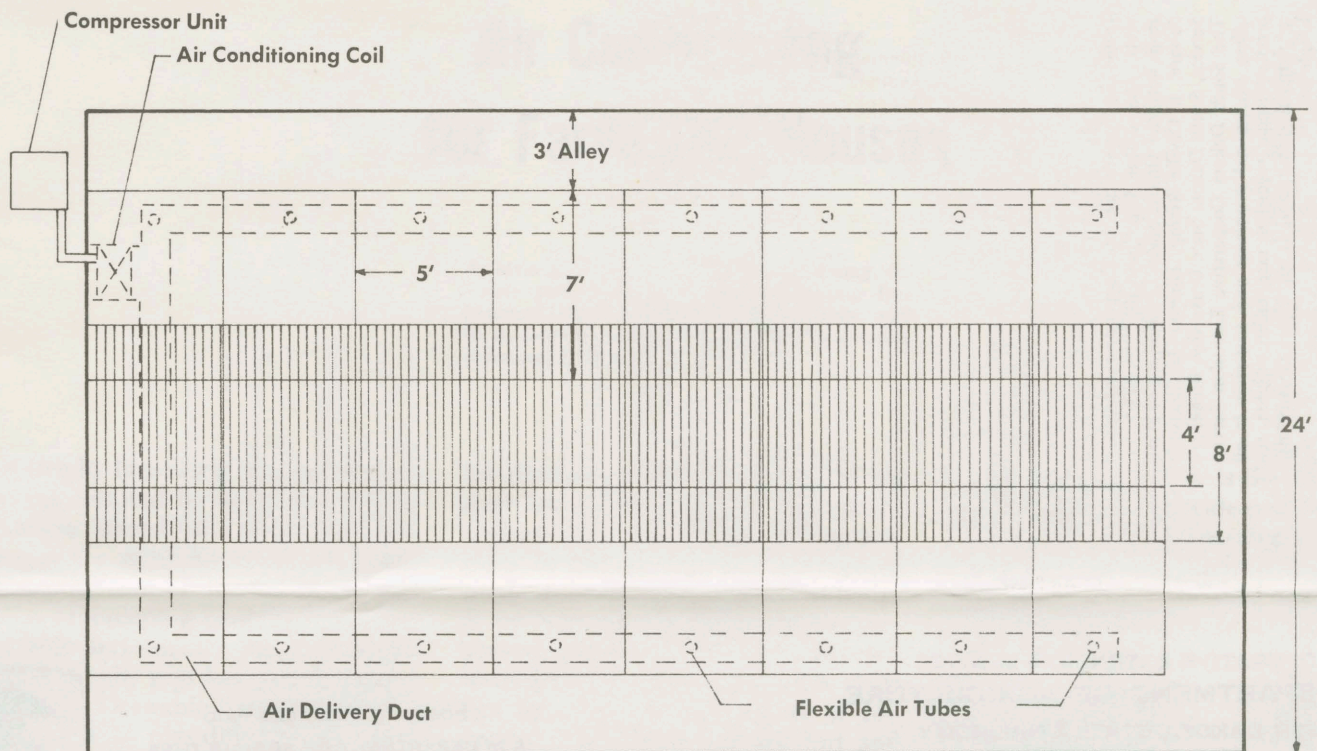


Figure 2—Farrowing Stall Barn—Face Out (8 Ft. Slotted Floor)

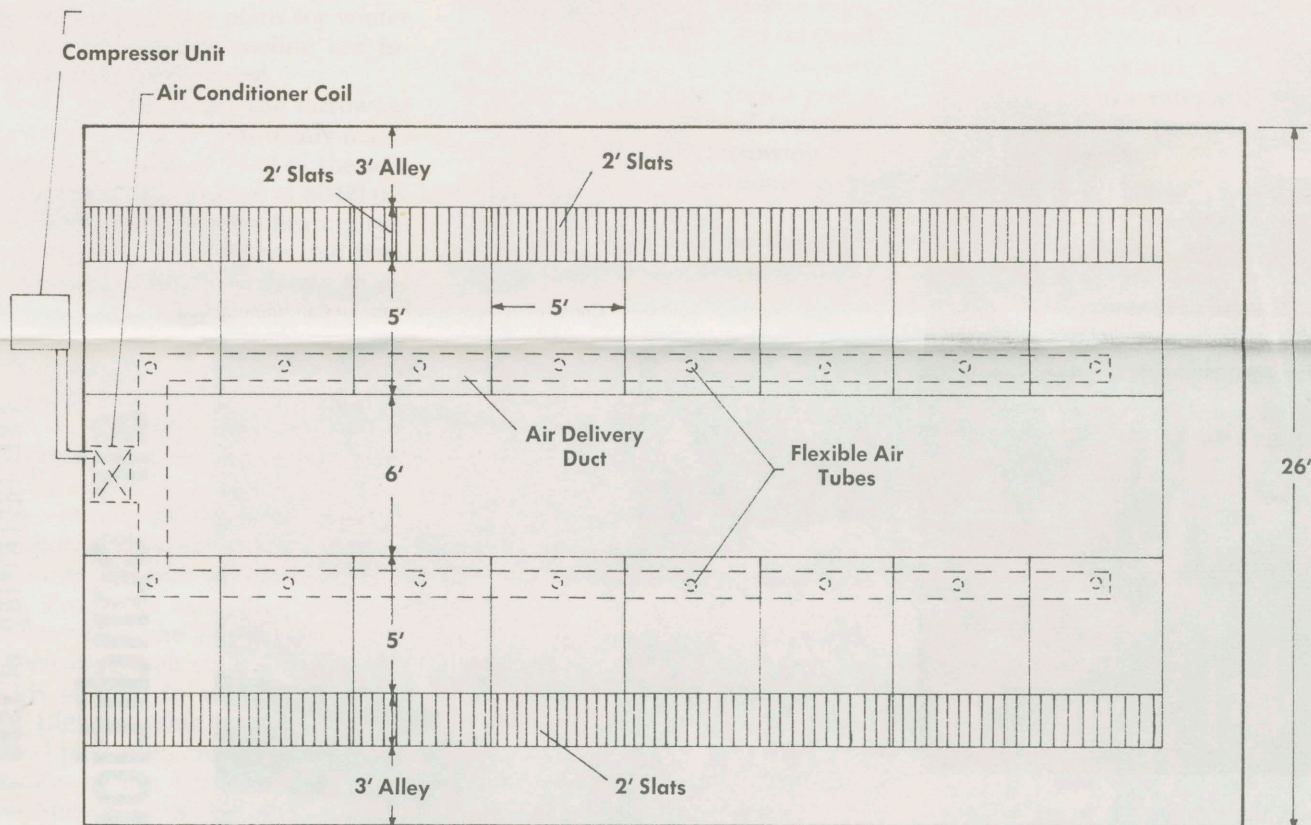


Figure 3—Farrowing Stall Barn—Face In (Optional Slotted Floor)

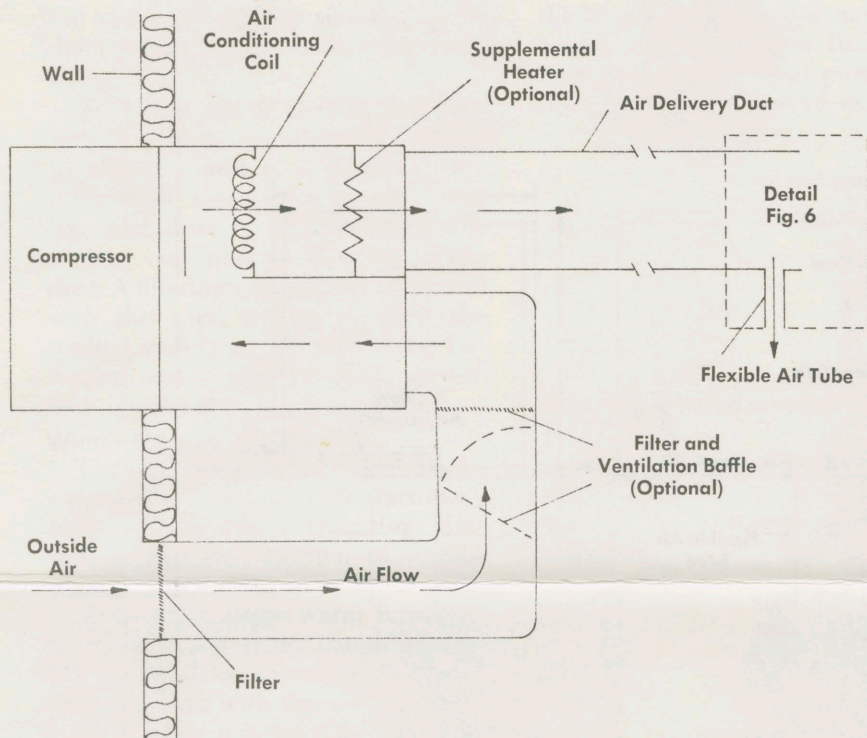


Figure 4—Package Unit—Compressor and Air Conditioning Coil Together

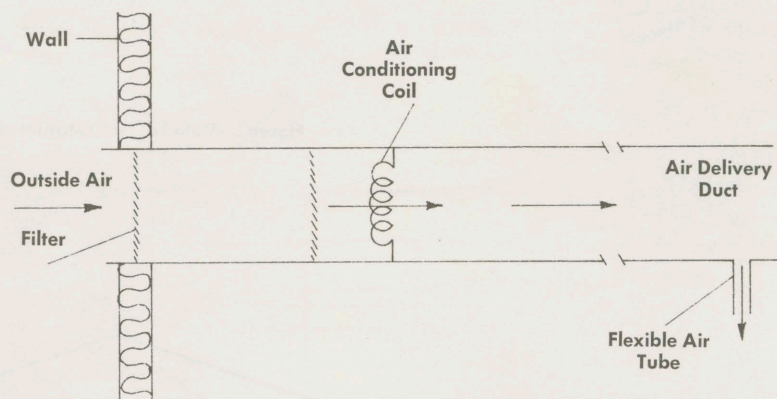
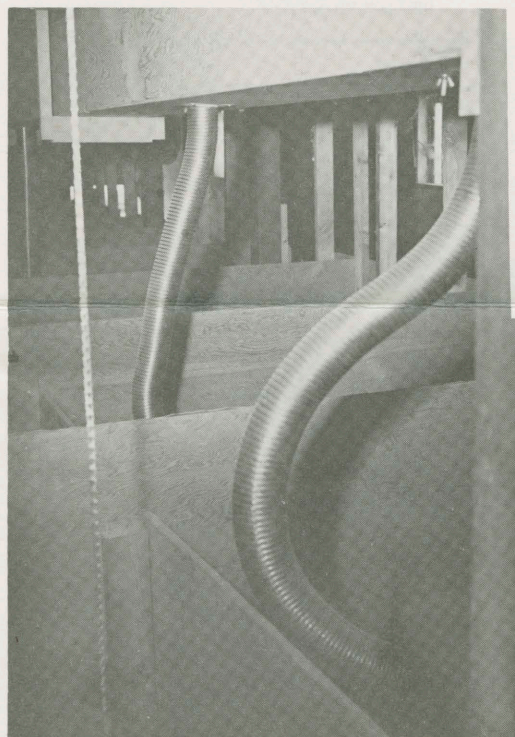


Figure 5—Split Unit—Compressor Separate From Air Conditioning Coil



Air distribution duct (at top) with flexible tubing leading into stalls.

COVER—The end of the flexible tubing (shown at top) should be about 2½ feet above the stall floor.

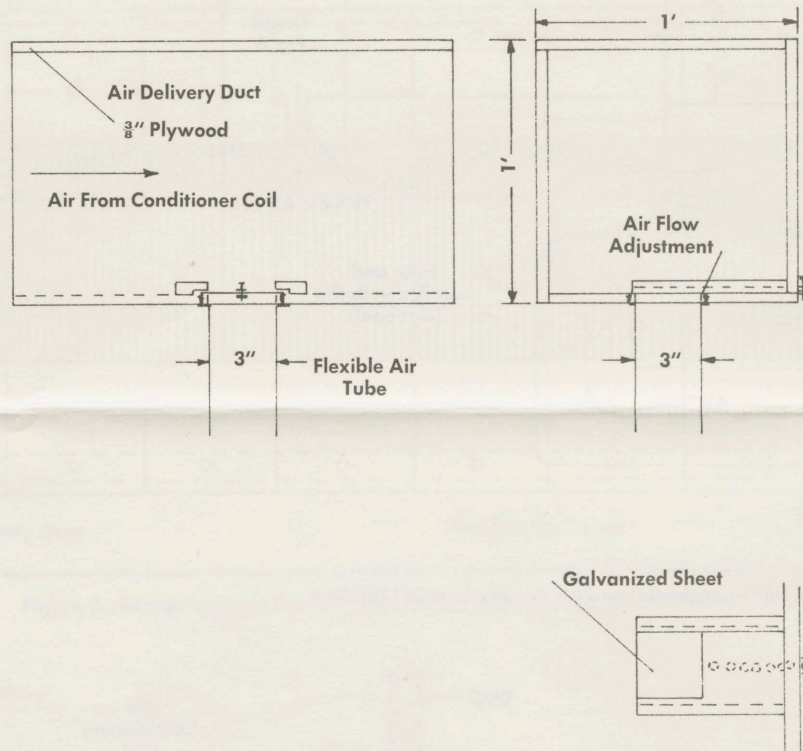
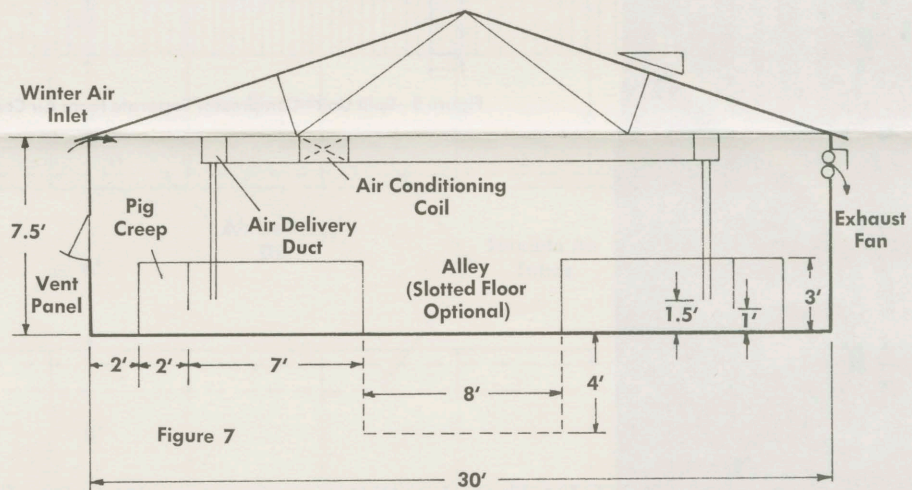


Figure 6—Detail of Air Distribution Ducts



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